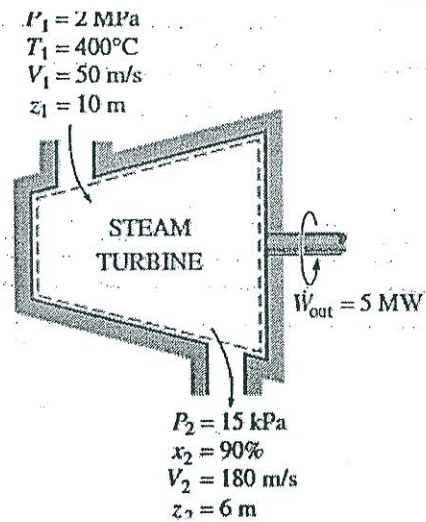Question 3

The power output of an adiabatic steam turbine is 5 MW, and the inlet and the exit conditions of the steam are as indicated in the figure shown.

(a) Calculate Δh, Δke, Δpe, and the entropy change of the steam per kg of the steam flowing through the turbine,

(b) Determine the work done per unit mass of the steam flowing through the turbine,

(c) Calculate the mass flow rate of the steam, and

(d) draw the process on a P-v and T-s diagrams

$P_1 = 2$ MPa
$T_1 = 400°C$
$V_1 = 50$ m/s
$z_1 = 10$ m

STEAM TURBINE

$\dot{W}_{out} = 5$ MW

$P_2 = 15$ kPa
$x_2 = 90\%$
$V_2 = 180$ m/s
$z_2 = 6$ m

Question 4

A Carnot heat engine receives heat from a reservoir at 900°C at a rate of 800 kJ/min and rejects the waste heat to the ambient air at 27°C. The entire work output of the heat engine is used to drive a refrigerator that removes heat from the refrigerated space at -5°C and transfers it to the same ambient air at 27°C. Determine:

(a) the thermal efficiency of the heat engine.

(b) the COP of the refrigerator.

(c) the maximum rate of heat removal from the refrigerated space

(d) the total rate of heat rejection to the ambient air.

Question 5

5. Air is compressed from an initial state of 100 kPa and 17°C to a final state of 600 kPa and 57°C. Determine the entropy change of air during this compression process by using (a) property values from the air table and (b) average specific heats.